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Non-availability of Amendment List No.

Amendment List No. to this publication is still with the printers and will be distributed as soon as received.

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AIR MINISTRY

Amendment List No. 14

to

December, 1956

A.P.2554C, Vol. 1

SARAH
(SEARCH AND RESCUE AND HOMING)

REMOVAL AND INSERTION OF LEAVES
PRELIMINARIES

Remove and destroy the Contents leaf and *insert* the new Contents leaf attached.

PART 2

After the Part 2 marker card *insert* Chapter 2 (four leaves) attached.

AMENDMENT RECORD SHEET

Record the incorporation of this amendment list and *destroy* this instruction sheet.

SIGNALS

CONTENTS

PRELIMINARIES

Amendment record sheet
Lethal warning
Note to readers
Layout of A.P.

PART I

LEADING PARTICULARS AND GENERAL INFORMATION

This document is part of an integrated file. If separated from the file it must be subjected to individual systematic review.

Chap.

- 1 Introduction
- 2 Circuit description, ASRI.100 (Man-carried beacon T.4165, search receiver R.4164 and power unit 4166)
- 3 Circuit description (Man-carried beacon SRI.23006 and search transmitter-receiver ARI.5876)
- 4A Airborne radio installations
- 4B Seaborne radio installations *(to be issued later)*
- 5A Constructional details—SRI.23006 and ARI.5876
- 5B Constructional details—ASRI.100 *(to be issued later)*
- 6 Installation, setting-up and operation, ASRI.100
- 7 Installation, setting-up and operation, SRI.23006 and ARI.5876
- 8A Tester performance Type 8104
- 8B Tester performance Type 8326
- 9 "Kalium" dry batteries

PART 2

TECHNICAL INFORMATION (SERVICING)

- 1 Rescue craft equipment *(to be issued later)*
- 2 Beacon equipment SRI.23006

PART 3

FAULT DIAGNOSIS

- 1 General fault finding information *(to be issued later)*

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(A.L.14, Dec., 56)

Chapter 2

BEACON EQUIPMENT SRI.23006 (SERVICING)

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GENERAL

1. A tester performance Type 8326 (Ref. No. 10S/16723) will be required. A front panel view of the tester performance Type 8326 is shown in fig. 1.

2. This portable tester performance provides metering and functional checking facilities for the periodical inspection of the beacon equipment and battery, and is described in detail in Part 1, Chap. 8B of this Air Publication. The facilities provided may be summarized as follows:—

- (1) Measurement of the beacon battery voltage on load.
- (2) Measurement of the beacon HT current consumption.
- (3) Short-circuit test of the Kalium LT section of the beacon (SARAH) battery.
- (4) Frequency check of the beacon.
- (5) Indication of the beacon transmitter output power.
- (6) Functional check of the beacon in all operating conditions.
- (7) Provision of suitable output and synchronizing signals for the external display of the beacon output waveforms.

- (8) Measurement of the tester's internal batteries.
- (9) Provision is made for the calibration of the tester against a frequency sub-standard, thus enabling the frequency of the beacon equipment to be measured to the required degree of accuracy.

3. It is recommended that the beacon equipment be tested in conjunction with the tester performance at fortnightly and monthly intervals as described in para. 4 and 10.

FORTNIGHTLY INSPECTION

Equipment required

4. Tester performance Type 8326, with a low-impedance headset (e.g. Ref. No. 10AH/9). Monitor Type 56 (Ref. No. 10T/6100) or similar triggered oscilloscope (e.g. Monitor Type 101). Crystal-checked signal source, range 240 to 250 Mc/s, such as the wavemeter Type 1433 (Ref. No. 10T/547).

Preliminary...

5.

- (1) Ensure that the internal batteries of the tester performance are connected.

- (2) Remove the beacon transmitter from its stowage, but do not remove the speech unit or battery from the life jacket.
- (3) Remove the sealing caps from the aerial fittings on top of the tester performance. Insert the aerial rods through the rubber seals into their sockets and fix the beacon transmitter in the clip at the right-hand end of the top of the tester casing, with its leads to the right.

8. Ensure that the receiver (in the tester performance) control frequency calibration has been checked against the wavemeter within the previous twenty-four hours, or six hours in climates subject to rapid changes in temperature. If not, check as described in para. 23.

Testing the beacon transmitter

9. Proceed as follows:—

- (1) Switch on the beacon transmitter. If the

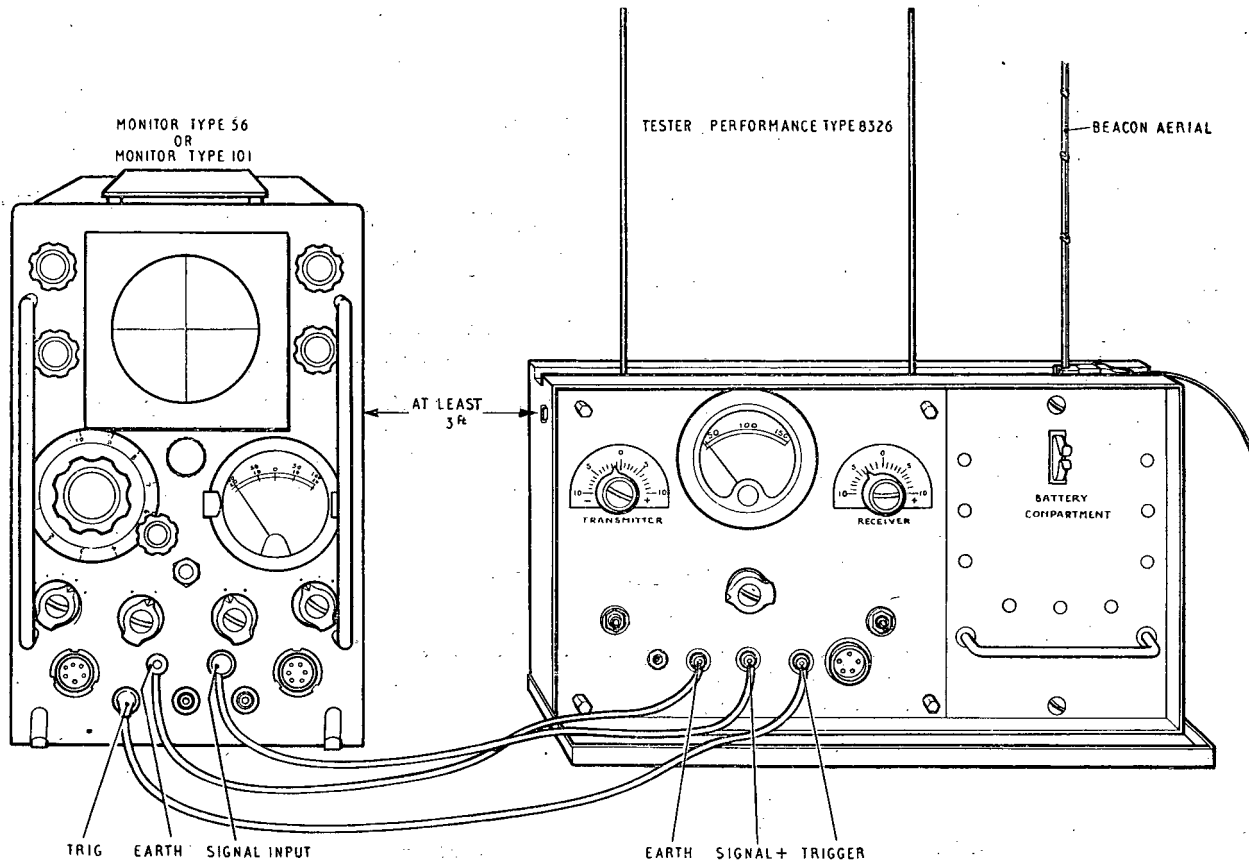


Fig. 1. Tester performance Type 8326 coupled to monitor for testing SARAH beacon.

- (4) Position the monitor Type 56 to the left of the tester, at least three feet from it. No other metal object must be situated within three feet of the SARAH beacon aerial.

Testing the internal batteries of the tester performance

6. Before the beacon assembly is tested the switch plunger on the beacon transmitter must be pushed in so that the beacon is switched off.

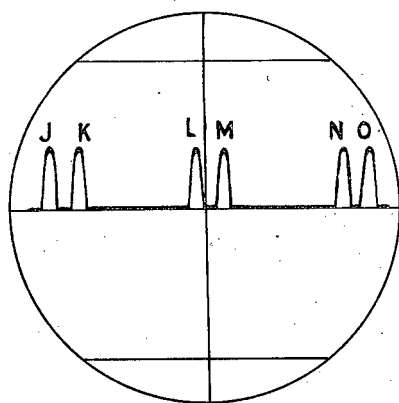
7. The internal batteries of the tester performance must then be checked as follows:—

- (1) Set the tester performance selector switch to INT. HT to check the voltage of the internal HT battery load. If the meter reading is less than 70, renew the battery as described in para. 21.
- (2) Set the selector switch to INT. LT. This checks the voltage of the internal LT battery on load. If the meter reading is less than 110, renew the battery as described in para. 21.

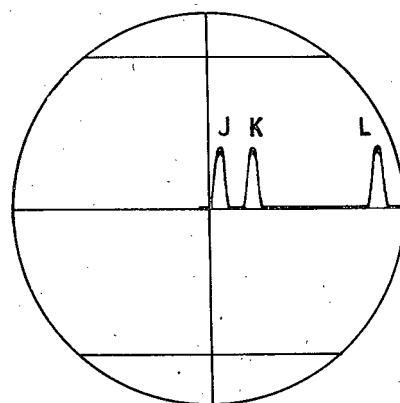
beacon battery is fitted with an isolating switch, remove the switch release pin.

- (2) Plug the headset (para. 4) into the phone-jack on the front panel of the tester, and set the selector switch on the tester performance to BEACON. Allow approximately twenty seconds for the beacon to warm up, after which the characteristic low frequency beacon tone should be heard in the headset.
- (3) Rotate the RECEIVER control on the tester performance for maximum meter indication on the tester. The RECEIVER control pointer should lie between +2 and -2 on the graduated scale. Verify that a low-pitched tone is audible in the headset.
- (4) As shown in fig. 1, connect the SIGNAL + terminal on the front panel of the tester performance to the SIGNAL INPUT of the monitor Type 56, and similarly the TRIGGER and EARTH terminals on the tester performance to the TRIGGER and EARTH terminals of the monitor.

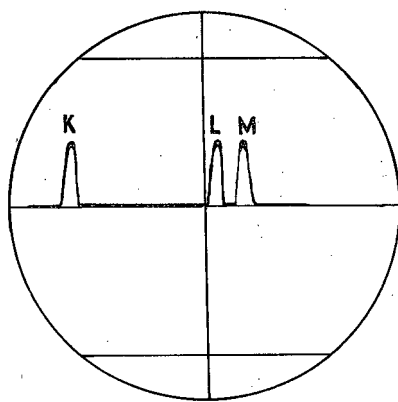
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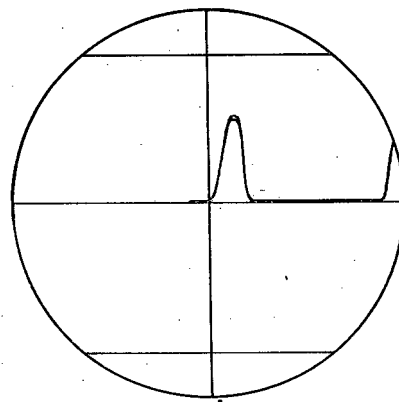
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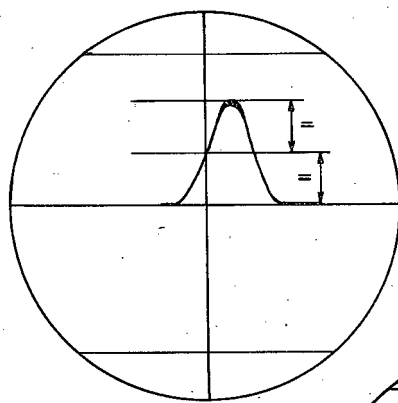
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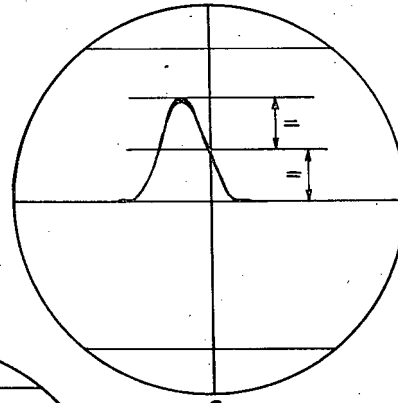
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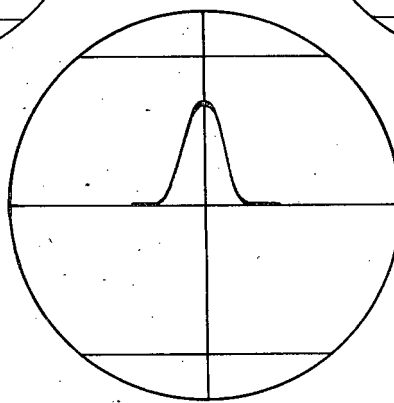
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e



f



g

Sarah -
Beacon output limits (waveforms) Fig. 2

AIR DIAGRAM
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(A.L.14 Dec '56)

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- (5) Verify by the methods described in the following sub-para. (6) to (9) that the characteristics of the beacon output fall within the limits given:—
- (a) Group repetition frequency: 210 g.p.s. ± 5 g.p.s.
 - (b) Pulse width: Codes A, B and C, 7 ± 3 μ s; Code D 9 ± 4 μ s.
 - (c) Pulse spacing (coding)

Code A—Red sleeve	95–129 μ s
Code B—Blue sleeve	130–169 μ s
Code C—Yellow sleeve	170–224 μ s
Code D—Green sleeve	225–300 μ s

Note . . .

The limits quoted in sub-para. 5 apply only when a beacon is supplied from 420V to 450V HT, 90V HT and 6.3V LT. On lower voltages the signal characteristics may be somewhat outside these limits. The battery pass figures as measured on the tester performance correspond to 375V HT, 78V HT and 6V LT.

- (6) Group repetition frequency
- (a) Place the switch on the performance tester in the CRO position.
 - (b) Set the TB SPEED μ s control on the monitor Type 56 to the appropriate range, e.g. 20,000, to show several groups of pulses on the monitor CRT screen as shown at diagram 'a' of fig. 2.
 - (c) Set the X SHIFT MICROSECONDS control on the monitor to zero and by means of the X SHIFT (PRESET) control move the trace on the CRT so that the first pulse of the group (pulse J of 'b' of fig. 2) is coincident with the vertical line of the monitor CRT.
 - (d) By means of the X SHIFT MICROSECONDS control move the trace along until the first pulse of the next group (pulse L of 'b' of fig. 2) is coincident with the original position of the first pulse of the previous group as shown in diagram 'c' of fig. 2. The reading as indicated by the X SHIFT MICROSECONDS control multiplied by the appropriate scale factor (determined by the position of the TB SPEED μ s control) gives the time interval in microseconds between groups of pulses. Reciprocal of this gives the repetition frequency in groups per second (g.p.s.) and the result must be within the limits, stated, e.g.:—Setting of the TB SPEED μ s control 20,000. X SHIFT MICROSECONDS control registers 2.65 microseconds, therefore, the time interval between groups is $2.65 \times 2,000$ microseconds, i.e. 5,300 microseconds. The reciprocal of this is 189 g.p.s. which is within the limit stated, i.e. 210 g.p.s. ± 50 g.p.s.
- (7) Pulse width
- (a) Set the monitor TB SPEED μ s control to the appropriate range (e.g. 50 position)

to show one pulse only on the CRT (diagram 'd' of fig. 2). Set the X SHIFT MICROSECONDS control to zero.

- (b) By means of the monitor X SHIFT PRESET control set the pulse as shown at diagram 'e' of fig. 2 (i.e. where the vertical line bisects the leading slope of the pulse). By means of the X SHIFT MICROSECONDS control move the trace until the vertical line bisects the trailing slope of the pulse as shown at diagram 'f' of fig. 2. The reading as shown by the X SHIFT MICROSECONDS control multiplied by the appropriate range factor gives the pulse width in microseconds, e.g.:—Assume that the Code D beacon is under examination. The TB SPEED μ s control setting is '50.' The X SHIFT MICROSECONDS control indicates 2.9. Therefore, the pulse width is 2.9×5 which is 14.5 microseconds. As this is outside the limits for the code D beacon (refer to sub-para. (5)) the beacon should be rejected.
- (8) Pulse spacing (coding)
- (a) This, as for the pulse width measurement, is dependant on the coding of the beacon.
 - (b) Set the TB SPEED μ s control on the monitor to the appropriate range to give two pulses on the timebase (CRT screen). For code A and B, 200 on the TB SPEED μ s control is the most suitable range and for code C and D use the 1,000 range.
 - (c) Set the X SHIFT MICROSECONDS control to the zero position. By means of the X SHIFT PRESET control set the first pulse of the group as shown at diagram 'g' of fig. 2, i.e. where the vertical line on the CRT is coincident with the peak of the pulse.
 - (d) By means of the X SHIFT MICROSECONDS control move the trace until the second pulse of the group occupies the position previously occupied by the first pulse. The reading of the X SHIFT μ s control multiplied by the appropriate range figure will give the time interval between pulses. The time interval should be within the limits stated in sub-para. (5). If this is not the case, reject the beacon, e.g.:—Code C beacon under test. TB SPEED μ s control set to the 1,000 range. X SHIFT MICROSECONDS control indicates 2.16, therefore the time interval between pulses (in groups) is 2.16 multiplied by 100, i.e. 216 μ s which is within the limits stated.
- (9) Switch off the tester performance, the beacon equipment and, where appropriate, refit the pin for the beacon battery isolating switch. **ALWAYS SET THE SELECTOR SWITCH TO 'OFF' WHEN THE TESTER IS NOT IN USE, OTHERWISE THE INTERNAL BATTERIES WILL DISCHARGE. THE METER MAY ALSO SUFFER DAMAGE**

DURING TRANSIT AS THE PROTECTIVE SHORT-CIRCUIT IS APPLIED ONLY IN THIS POSITION.

MONTHLY INSPECTION

10. The following tests should be made prior to installation, and subsequently monthly, on all beacon assemblies. The equipment must be completely removed from the life jacket before testing, and the coding unit disconnected from the battery socket. Mechanical inspection as detailed in para. 20 must be made prior to refitting.

Equipment required

11. Tester performance Type 8326 with a low-impedance headset (e.g. 10AH/9). Monitor Type 56 (Ref. No. 10T/6100) or similar triggered oscilloscope (e.g. Monitor Type 101). Crystal-checked signal source range 240 to 250 Mc/s, such as the wavemeter Type 1433 (Ref. No. 10T/547).

Preliminary

12.

- (1) Ensure that the internal batteries of the tester performance are connected.
- (2) Remove the sealing caps from the aerial fittings on the top of the tester performance, and insert the two aerial rods through the rubber seals into their sockets.
- (3) Ensure that the receiver (in the tester performance) control frequency calibration has been checked against the wavemeter within the previous twenty-four hours, or six hours in climates subject to rapid changes in temperature. If not, check as described in para. 23.
- (4) Fit the battery-connector plug assembly on the tester performance into the SARAH battery and lock in position with the ring-nut.
- (5) Connect the coding unit of the SARAH beacon assembly to the CODING UNIT socket on the front panel of the tester performance and lock into position with the ring-nut.
- (6) Fix the SARAH beacon transmitter in the clip at the right-hand end of the top of the tester performance casing, with the leads to the right.
- (7) Position the monitor Type 56 at the opposite end of the tester, at a distance of not less than three feet from it. No other metal object must be situated within three feet of the SARAH beacon aerial. Switch on the monitor.

Testing the internal batteries

13. Before the beacon assembly is tested, the internal batteries of the performance tester must be checked as follows:—

Note . . .

The switch plunger on the beacon transmitter must be pushed in so that the beacon is OFF during the tests described in para. 13, sub-para. (1) and (2) and para. 14, sub-para. (1).

- (1) Set the tester performance selector switch to INT. HT to check the voltage of the internal HT battery on load. If the meter reading on the

tester performance is less than 70, renew the battery as described in para. 21.

- (2) Set the selector switch to INT. LT. This checks the voltage of the internal LT battery on load. If the meter reading is less than 110, renew the battery as described in para. 21.

Testing the beacon power unit Type 8175 (battery unit) (10K/18521)

14. Proceed as follows:—

- (1) Set the selector switch on the tester performance to OFF. Depress the SC TEST switch to the ON position for **TWO SECONDS ONLY**. A longer period will unduly shorten the shelf-life of the beacon battery, as the Kalium section is virtually short-circuited (10 ohms) during this test. If the meter reading on the tester is dropping or if the minimum reading is less than that quoted in the instructions on the inside of the performance tester front cover, renew the battery.
- (2) Pull out the plunger on the beacon transmitter to switch the beacon ON and if the beacon battery is fitted with an isolating switch, remove the switch release pin.
- (3) Set the selector switch on the tester to BATTERY RB7.LT to test the Kalium LT section of the battery on load. Renew the battery if the meter reads less than 120.
- (4) Set the selector switch on the tester to BATTERY RB7.HT1 to test the HT1 (90V) section of the battery on load. Renew the battery if the meter reading is below 78.
- (5) Set the selector switch on the tester to BATTERY RB7.HT2 to test the HT2 (450V for battery without isolating switch and 435V for battery with switch) section of the battery on load. Renew the battery if the meter reading is below 75.

Measuring the SARAH beacon HT2 consumption

15. Proceed as follows:—

- (1) Set the selector switch on the tester to HT mA.
- (2) With the beacon operating in the "beacon" condition, the meter reading on the tester should not exceed 40. If the reading is above 40, reject the beacon equipment under test. **DO NOT PRESS THE HT mA SWITCH ON THE TESTER IF THE READING IS OVER 40 OR DAMAGE TO THE METER WILL RESULT.** If the reading on the meter is definitely below 40, depress the HT mA switch to SENS. Reject the beacon if the meter reading is over 178.
- (3) On LISTEN, reject the beacon if the meter reading exceeds 94. **DO NOT PRESS** the HT mA switch.
- (4) On TALK, reject the beacon if the meter reading exceeds 136. **DO NOT PRESS** the HT mA switch.

Functional tests

16. These are as follows:—

- (1) Plug the headset into the phones jack on the front panel of the tester performance.

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- (2) Set the selector switch to BEACON, and rotate the RECEIVER control for maximum meter indication. The RECEIVER pointer should lie between +2 and -2 on the graduated scale. Verify that a low-pitched tone is audible in the headset.
- (3) Set the selector switch to LISTEN, and allow approximately one minute for the transmitter in the tester performance to warm up. Press the LISTEN button on the SARAH speech unit, and verify that a tone is audible in the speech unit speaker/microphone. Verify that the pitch of this tone varies when the TRANSMITTER control on the tester performance is rotated. The tone should also be monitored in the headset connected to the tester performance.
- (4) Set the selector switch on the tester performance to TALK. Wait until the tone from the transmitter in the tester dies away, and press the TALK button on the SARAH speech unit. Whistle into the speech unit microphone. The meter reading should then vary and the whistle should be audible in the headset.

Note . . .

Reset the RECEIVER control, if necessary, to obtain maximum variation in the meter reading.

Examination of output waveforms

17. These should be examined as follows:—

- (1) Connect the SIGNAL + terminal on the front panel of the tester performance to the SIGNAL INPUT of the monitor Type 56 and, similarly, the TRIGGER and EARTH terminals on the tester performance to the TRIGGER and EARTH terminals of the monitor.

Note . . .

Use the same leads in testing all beacons, to facilitate comparison of amplitude and to avoid misleading indications.

- (2) Verify (*refer to para. 9*) that the following characteristics of the BEACON output fall within the limits given:—

- (a) Group repetition frequency: 210 ± 50 g.p.s.
- (b) Pulse width: Codes A, B and C, $7 \pm 3 \mu\text{s}$; Code D, $9 \pm 4 \mu\text{s}$.
- (c) Pulse spacing (coding):

Code A—Red sleeve	95–129 μs
Code B—Blue Sleeve	130–169 μs
Code C—Yellow sleeve	170–224 μs
Code D—Green sleeve	225–300 μs

- (3) Verify that the amplitude of the beacon pulses as seen on the monitor Type 56 does not differ unduly from that of other beacons.

Conclusion of tests

18. Switch OFF the tester performance, the beacon equipment and, where appropriate, refit the pin for the beacon battery isolating switch.

WARNING

Always turn the selector switch on the tester performance to the OFF position when the tester is not in use. The internal batteries will discharge if this precaution is not taken and the meter may be damaged during transmit since the protective short-circuit is applied in the OFF position of the selector switch only.

19. The following Table summarizes the tests to be made on the beacon equipment using the tester performance alone.

TABLE

Selector Switch on tester performance	SARAH beacon condition	Pass limits	Notes
INT. HT	OFF	70 minimum	
INT. LT	OFF	110 minimum	
OFF	OFF		S/C TEST. Pass figure on tester instruction panel
BATT. RB7. LT	BEACON	120 minimum	
BATT. RB7. HT1	BEACON	78 minimum	
BATT. RB7. HT2	BEACON	75 minimum	
HT MA	BEACON	40 maximum	
HT MA	BEACON	178 maximum	HT MA switch to SENS.
HT MA	LISTEN	94 maximum	
HT MA	TALK	136 maximum	
BEACON	BEACON	+2 and -2	RECEIVER dial used
LISTEN	LISTEN		Pitch should vary with TRANSMITTER dial setting
TALK	TALK		Reading should vary when beacon is modulated

WARNING : Turn selector switch to OFF after use.

MONTHLY INSPECTION (MECHANICAL)**20. Proceed as follows:—**

- (1) Examine the beacon shrouds, overall cover and aerial retaining ring for tears or signs of perishing.
- (2) Verify that the pins of the coding unit plug are clean and not bent or broken.
- (3) Using a suitable grub screwdriver, verify that the screws securing the switch face-plate to the body of the speech unit are fully tightened; also the screws around the mic/speaker grille.
- (4) Using a 6BA box spanner, tighten, as far as possible without using a tommy bar, the nuts securing the base of the aerial, the plunger switch and the tuning cover-plate to the beacon transmitter.
- (5) Inspect the battery for dents and signs of leakage or corrosion. When reconnecting the battery, tighten the coding unit retaining ring-nut with a half-inch Whitworth flat spanner of suitable thickness.

Note . . .

IT IS NOT SUFFICIENT TO FINGER-TIGHTEN THE RETAINING RING-NUT. ONLY THE USE OF A SPANNER CAN ENSURE A WATER-TIGHT SEAL.

Do not forget to pull the coding unit rubber shroud down to the base of the battery socket.

Renewing the batteries in the tester performance**21. The following batteries are required:—**

- (1) HT: 90V battery (Ref. 5J/3374).
- (2) LT: 7.5V battery (Ref. 5J/3373).

22. Proceed as follows:—

- (1) Release the hinged fasteners at the top left-hand and right-hand sides of the case and lower the front cover.
- (2) Turn the two quick-release fasteners of the BATTERY COMPARTMENT until their slots are vertical and withdraw the battery compartment.
- (3) Turn the knurled-head screw at the rear of the compartment counter-clockwise (as viewed from the front) until the battery clamp has

moved backwards far enough to release the batteries. Disconnect and remove the old batteries.

- (4) Place the new batteries in the compartment with the LT battery towards the front. The LT output socket should be towards the rear and the HT+ socket to the right, as viewed from the front of the compartment.
- (5) Connect the battery terminals to the clips and the plug of the tester leads as appropriate.
- (6) Tighten the battery clamp until the batteries are firmly held by the rubber grommets.
- (7) Ensure that the slots of the quick-release fasteners are horizontal, push the battery compartment back into the case and snap the fasteners home.

Checking the calibration of the tester performance receiver**23. Proceed as follows:—**

- (1) The calibration of the receiver unit in the tester performance should be checked when required against a crystal-checked signal source such as the wavemeter Type 1433 (Ref. 10T/547). The period of time between checking and using the tester should not exceed twenty-four hours. In climates where rapid changes of temperature occur this period should not exceed six hours.
- (2) Couple the output of the wavemeter to the receiver (right-hand) aerial of the performance tester by means of a loop, and set it to give a modulated output at 244 Mc/s. (This is a crystal-check point on the wavemeter Type 1433).
- (3) Plug a low-impedance headset into the jack annotated PHONES on the front panel of the tester performance, and set the selector switch on the tester to TALK. Set the RECEIVER control to the setting given on the instruction panel on the tester, and adjust the preset capacitor beneath the RECEIVER control until the note is heard in the headset.
- (4) Check that the peak amplitude of the note occurs at the setting of the RECEIVER control described in sub-para. (3).
- (5) Set the selector switch to OFF.

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